◆ INLAND DUNE SPECIAL-STATUS PLANT SPECIES

INTRODUCTION

Inland dunes are extremely limited to the Delta, occurring only in the vicinity of the Antioch Dunes Ecological Reserve. This habitat supports two plant and one butterfly species listed as endangered under the federal Endangered Species Act. Both plants are State-listed endangered species. Visions are provided here for the two plant species, Antioch Dunes evening-primrose (*Oenothera deltoides* ssp. *howellii*) and Contra Costa wallflower (*Erysimum capitatum* var. *angustatum*).

SPECIES DESCRIPTIONS

ANTIOCH DUNES EVENING-PRIMROSE. Antioch Dunes evening-primrose is a showy, white-flowered, highly branched perennial herb with grayish toothed or divided leaves. It is a member of the evening primrose family (Onagraceae). Antioch Dunes evening-primrose is both state and federally listed as endangered. Additionally, this species is considered rare, threatened, or endangered in California and elsewhere by the California Native Plant Society (CNPS) (List 1B). Antioch Dunes evening-primrose is endemic to loose sand and stabilized dunes near river margins in the vicinity of Antioch. It is known from only 7 occurrences (Skinner and Pavlik 1994). Most remaining plants occur at the Antioch Dunes National Wildlife Refuge. In 1992, the population size of this species at 2 disjunct sites on the Antioch Dunes was only 1,200 plants (Greene 1994). Attempts have been made to introduce the species to several other locations with remnant dunes, including Brannan Island State Recreation Area in Rio Vista. Antioch dunes evening-primrose evolved from desert flora which occupied the sand dunes of the Sacramento Valley 5,000 to 8,000 years ago (Green 1994). In recent times, dune habitat in the Delta has been lost to conversion to agriculture, sand mining, and industrial development. Present threats include competition for water with ripgut brome (*Bromus diandrus*) and recreational and fire control activities. The recent trend for Antioch Dunes evening-primrose is one of stability, but its total population size and distribution is still very limited (DFG 1991).

CONTRA COSTA WALLFLOWER. Contra Costa wallflower, a member of the mustard family (Brassicaceae), is a coarse-stemmed, erect, herbaceous biennial herb with yellowish-orange flowers. Contra Costa wallflower is state and federally listed as endangered and is also on CNPS's List 1B. Contra Costa wallflower co-occurs with Antioch Dunes evening-primrose at the Antioch Dunes NWR, and is known from only 2 occurrences at the Antioch Dunes. It is threatened by factors similar to those affecting Antioch Dunes evening primrose. The wallflower population is surveyed annually and has shown considerable increase since 1978 (DFG 1991).

VISIONS

The vision for Antioch Dunes evening-primrose is to recover this federally and State-listed endangered species.

The vision for Contra Costa wallflower is to recover this federally and State-listed endangered species.

The overall vision for both species is to protect existing populations and ensure the long-term viability of the species through habitat restoration, enhancement, and appropriate management. Effective management techniques would be developed and employed to protect existing populations. Existing knowledge acquired primarily at the Antioch Dunes Refuge would serve as a basis of establishing effective management techniques. Prescribed burning is an example of a management technique that has been successful in promoting Antioch Dunes evening-primrose colonization. Controlling non-native competitors would also be an element of on-going management for the species. One study showed that removal of ripgut brome near adult Antioch Dunes evening-primrose plants increased seedling germination (Greene 1994).

Establishing additional populations would greatly increase the recovery potential for Antioch Dunes evening-primrose and Contra Costa wallflower. To promote the expansion of the species, historic inland dunes adjacent to existing ecological reserves in the Sacramento-San Joaquin Delta Ecological Zone would be reestablished and species establishment promoted. Sand dune creation techniques developed at the Antioch Dunes would be employed. Protecting and restoring inland dune scrub that serves as habitat for Antioch Dunes evening-primrose and Contra Costa wallflower would be enhanced by identifying areas that are not currently managed for their resource values. Appropriate methods to protect and restore identified areas would be developed. Protected habitat areas would be evaluated to determine effective restoration management practices to increase habitat value. The results of these evaluations would determine how habitat for Antioch Dunes evening-primrose and Contra Costa wallflower would be protected and restored.

Integration with Other Restoration Programs

Efforts to restore habitat for Antioch Dunes evening-primrose and Contra Costa wallflower will involve cooperation with programs managed by the Antioch Dunes National Wildlife Refuge. Cooperation from agencies with responsibility or authority for restoring inland dune habitat will be solicited. These include:

- California Department of Fish and Game,
- U.S. Fish and Wildlife Service,
- U.S. Army Corps of Engineers, and
- the Delta Protection Commission.

Linkage with Other Ecosystem Elements

Antioch Dunes evening-primrose and Contra Costa wallflower are linked with a habitat ecosystem element, inland dune scrub. These species and habitat elements are closely associated with each other and are limited to the area near the Antioch Dunes Ecological Reserve. Non-native plant species are stressors that compete with Antioch Dunes evening-primrose and Contra Costa wallflower for habitat.

Objective, Targets, Actions, and Measures

The Strategic Objective is to achieve, first, recovery and then large self-sustaining populations of at-risk native species dependent on the Delta, Suisun Bay, and Suisun Marsh.

Species Targets

Antioch Dunes Evening-primrose and Contra Costa Wallflower: Continue protection of and expand the size of these species' Antioch Dunes populations; enhance and restore suitable habitat at and in the vicinity of the Antioch Dunes; and achieve recovery goals identified in the USFWS recovery plan.

Long-term Objective: Establish additional self-sustaining populations of Antioch Dunes evening-primrose and Contra Costa wallflower and similar declining endemic species located throughout their original native range in the vicinity of Antioch Dunes.

Short-term Objective: Protect existing populations of the species and restore habitat to provide sites for establishing addition self-sustaining populations.

Rationale: The two species listed here are examples of plants that are endemic to Antioch Dunes. Restoration of these species to the point where they were no longer in danger of extinction would indicate that dune restoration and protection projects in the region had succeeded.

Stage 1 Expectations: The status of the two species listed here will have improved. Surveys of present ranges of the species, studies of their ecological requirements, and identification of key restoration sites will have been completed.

Restoration Actions

The general target for the inland dune special-status plant species is to establish and protect a large enough number of populations of each species to maintain genetic diversity, prevent species extinction

from localized catastrophic occurrences, and promote the sustainability of each species.

The following actions would contribute to improving the inland dune special-status plant species populations:

- Develop appropriate methods to protect and restore habitat and populations of the inland dune special-status plant species.
- Manage protected areas occupied by the inland dune special-status species to reduce disturbance of dunes and dune vegetation.
- Manage protected areas occupied by the species to promote conditions favorable for the establishment, growth, and vigor of the species. Include management techniques such as prescribed burning and exotic weed control.
- Acquire historic inland dunes adjacent to existing ecological reserves and reestablish dune habitat and inland dune special-status species populations.

MSCS Conservation Measures

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve species habitat or population targets.

Antioch Dunes Evening-Primrose and Contra Costa Wallflower

- Coordinate protection and restoration of inland dune scrub habitats with other programs (e.g., U.S. Fish and Wildlife Service recovery plans and management of the Antioch Dunes Preserve) that could affect management of occupied and historic habitat areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Conduct surveys to locate potential habitat restoration sites on Tinnin soils and identify opportunities for and implement permanent protection, restoration, and management of these habitat areas to enhance habitat conditions for these species.
- Enhance and maintain existing populations.
- Annually monitor establishment success and modify establishment and management techniques as needed using adaptive management.

References

Department of Fish and Game. 1991. Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants. Sacramento, CA.

Greene, Jule A. 1994. Rancho Santa Ana Botanic Garden Supports Research on Endangered *Oenothera* (Onagraceae). Plant Conservation. Vol 8(2). pp. 6-7.

Skinner, Mark W. and Bruce M. Pavlik. 1994. California Native Plant Society's Inventory of Rare and Endangered Vascular Plants of California. Publication No. 1. Fifth edition. California Native Plant Society. Sacramento, CA.

Department of Fish and Game. 1991. Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants. Sacramento, CA.

California Department of Fish and Game 1992 - CALFED Bay-Delta Program Special Status Plants and Animals Draft Affected Environment Technical Report (Appendix A. Federally Listed Plants and Animals) Sept. 23, 1996.

Multi-Species Conservation Strategy. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

Niehaus 1977 - CALFED Bay-Delta Program Special Status Plants and Animals Draft Affected Environment Technical Report (Appendix A. Federally Listed Plants and Animals) Sept. 23, 1996

Stone, R.D., G.L. Clifton, W.B. Davilla, J.C. Stebbins, and D.W. Taylor. 1987. Endangerment status of the grass tribe Orcuttieae and *Chamaesyce hooveri* (Euphorbiaceae) in the Central Valley of California.

Strategic Plan for Ecosystem Restoration. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

◆ LANGE'S METALMARK BUTTERFLY

INTRODUCTION

The Lange's metalmark butterfly, a federally listed endangered species are associated with inland dune habitats. The distribution and populations of these species have declined substantially, primarily as a result of the loss or degradation of these habitats within their range. The loss of habitat and declining condition of these species populations have warranted their listing as threatened or endangered under the federal Endangered Species Act.

Major factors that limit this resource's contribution to the health of the Delta are related to adverse effects of conversion of native habitats for agricultural, industrial, and urban uses, and land and water management practices that degrade habitats used by these species.

RESOURCE DESCRIPTION

The preferred habitat of Lange's metalmark, a butterfly, is inland dune scrub. The Lange's metalmark is dependent on its host plant, naked buckwheat. The present range of Lange's metalmark has been reduced to about 70 acres of suitable habitat within the Antioch Dunes National Wildlife Refuge and on a few small parcels of privately held land on the eastern flank of the refuge. Over a 9-day sampling period in 1977, biologists estimated that only 400 adult butterflies remain at the Little Corral site. From 1986 to 1991, the population increased exponentially, from approximately 160 butterflies to nearly 2,000. In 1992, the population fell to about one-third of the peak level, but by 1996 had recovered to more that 2,000 butterflies. A wide variety of stressors (e.g., land use, wildfire, non-native plant species, sand mining, fences, and human-related disturbance) that degrade this species' habitat have contributed to the endangered status of Lange's metalmark.

VISION

The vision for the Lange's metalmark butterfly is to recover this federally listed endangered species by increasing the existing Lange's metalmark population distribution and by increasing its abundance.

Protecting existing and restoring additional suitable inland dune scrub habitat will be critical to maintaining and increasing the abundance of the Lange's metalmark population in the Bay-Delta. Habitat restoration in the Sacramento-San Joaquin Delta Ecological Management Zone will help maintain healthy populations by increasing the quality and quantity of this species habitat.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

There are a number of programs that involve these species:

- U.S. Fish and Wildlife Service,
- California Department of Fish and Game (DFG),
- California State Parks and Recreation,
- Riparian Habitat Joint Venture, and
- DFG's Calhoun Cut Reserve.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Restoration of these species is integrally linked with restoration of seasonal wetland, riparian, inland dune, perennial aquatic, and grassland habitats in the Central Valley and are adversely influenced by the detrimental effects of invasive plant species.

OBJECTIVE, TARGETS, ACTIONS, AND MEASURES

The Strategic Objective is to achieve, first, recovery and then large self-sustaining populations of at-risk native species dependent on the Delta, Suisun Bay, and Susiun Marsh.

SPECIES TARGET: Continue protection of and expand the size of the Antioch Dunes population of the Lange's metalmark butterfly; enhance and restore suitable habitat at and in the vicinity of the Antioch

Dunes; and achieve recovery goals identified in the USFWS recovery plan.

LONG-TERM OBJECTIVE: Restore Lange's metalmark butterfly to populations throughout its inland dune scrub habitat, to the point where it can be removed from the federal endangered species list.

SHORT-TERM OBJECTIVE: Create multiple populations of Lange's metalmark butterfly within the Antioch Dunes region.

RATIONALE: Lange's metalmark butterfly is listed as endangered by the federal government because it exists as just one small population in one small protected area, Antioch Dunes Ecological Reserve. The reserve is a remnant of the coastal dune scrub habitat that was once widespread in the Antioch area. This butterfly depends on one host plant species, naked buckwheat, for the survival of its young. Thus protection of this site from disturbance, fires and invasions of exotic plant species is paramount for the survival of the butterfly.

STAGE 1 EXPECTATIONS: The population size and area inhabited by Lange's metalmark butterfly in Antioch Dunes Ecological Reserve will have been increased substantially. Restoration of the native dune scrub plant community and naked buckwheat populations will have continued both in the reserve and in suitable areas outside the reserve.

RESTORATION ACTIONS

The following general targets will assist in meeting the implementation objective:

- Increase the number and distribution of Lange's metalmark.

The following general programmatic actions will assist in meeting the targets:

- Implement control measures to eradicate invasive plant species.
- Increase the amount of inland dune scrub habitat.
- Develop cooperative management strategies with the Antioch Dune Ecological Reserve that protect and manage existing habitat areas.
- Maintain healthy populations of naked buckwheat within inland dune scrub habitats.
- Enhance the formation of active dunes by such means as importing clean sand of appropriate dimensions, reducing stabilizing vegetation, and increasing topographic relief, dune height, and the frequency of steep north/northwest facing erosional slopes with sparse vegetation cover.

MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve species habitat or population targets.

- Coordinate protection, enhancement, and restoration of inland dune scrub habitat with other federal and state programs (e.g., U.S. Fish and Wildlife Service species recovery plans and management of the Antioch Dunes Preserve) that could affect management of current and historic habitat areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Conduct surveys to locate potential habitat restoration sites on Tinnin soils and identify opportunities for and implement permanent protection, restoration, and management of these habitat areas to enhance habitat conditions for the Lange's metalmark.
- Monitor enhanced and restored habitat areas to determine the success of enhancement and restoration methods, and to determine the response of Lange's metalmark populations and management.

REFERENCES

Multi-Species Conservation Strategy. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

Strategic Plan for Ecosystem Restoration. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

◆ VALLEY ELDERBERRY LONGHORN BEETLE

INTRODUCTION

The valley elderberry longhorn beetle (VELB) is a federally listed threatened species associated with riparian habitats. The distribution and populations of this species has declined substantially, primarily as a result of the loss or degradation of habitat within its range. The loss of habitat and declining condition of these species populations have warranted their listing as threatened or endangered under the federal Endangered Species Act.

Major factors that limit this resource's contribution to the health of the Delta are related to adverse effects of conversion of native habitats for agricultural, industrial, and urban uses, and land and water management practices that degrade habitats used by these species.

RESOURCE DESCRIPTION

VELB has been found only in association with its host plant, elderberry (*Sambucus* spp.). Elderberry is a component of the remaining riparian forests and adjacent grasslands of the Central Valley. Entomologists estimate that the range of this beetle extends from Redding at the northern end of the Central Valley to the Bakersfield area in the south. Important stressors on VELB are fragmentation of riparian habitat; grazing; and excessive collection of the species for commercial, recreational, scientific, or educational purposes. Local populations can also be severely damaged by pesticides inadvertently drifting from nearby agricultural lands into occupied habitat areas.

VISION

The vision for VELB is to assist in the recovery of the VELB by increasing its populations and abundance through habitat restoration.

Protecting existing and restoring additional suitable riparian habitats and establishing new populations will be critical to recovery of the VELB in the Bay-Delta. Restoration of riparian habitats in the Sacramento-San Joaquin Delta Ecological Management Zone will help maintain healthy populations by increasing the quality and quantity of habitats used by these species.

The period required to achieve recovery of the VELB could be reduced by introducing the species into unoccupied or restored habitat areas. Such a strategy could be implemented through cooperative agreements with land management agencies or cooperative agreements with willing landowners. The VELB would also benefit from development and implementation of alternative designs for and maintenance of flood control, bank protection, and other structures that reduce their potential adverse effects on existing riparian habitats.

Restoration of ecosystem processes and habitats in other ecological management zones will also allow riparian vegetation to develop that will provide habitat for these species elsewhere in the Central Valley. The benefit of these restorations for recovery of the VELB would be increased by implementing restoration of riparian habitats in a manner that links isolated areas supporting existing VELB populations.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

There are a number of programs that involve these species:

- U.S. Fish and Wildlife Service,
- California Department of Fish and Game (DFG),
- California State Parks and Recreation,
- Riparian Habitat Joint Venture.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Restoration of these species is integrally linked with restoration of seasonal wetland, riparian, inland dune, perennial aquatic, and grassland habitats in the Central Valley and are adversely influenced by the detrimental effects of invasive plant species.

OBJECTIVE, TARGETS, ACTIONS, AND MEASURES

The Strategic Objective is to achieve, first, recovery and then large self-sustaining populations of at-risk native species dependent on the Delta, Suisun Bay, and Suisun Marsh.

SPECIES TARGET: Maintain and restore connectivity among riparian habitats occupied by the valley elderberry longhorn beetle and within its historic range along the Sacramento and San Joaquin rivers and their major tributaries.

LONG-TERM OBJECTIVE: Restore riparian habitat throughout the Central Valley that includes components (i.e., elderberry thickets) suitable for populations of valley elderberry beetle throughout its native range.

SHORT-TERM OBJECTIVE: Contribute to recovery of this species as defined in the Valley Elderberry Longhorn Beetle Recovery Plan (U.S. Fish and Wildlife Service 1984) by restoring habitat for the species in riparian restoration projects in its native range where feasible.

RATIONALE: The valley elderberry longhorn beetle is a federally listed threatened species, although its status and factors limiting its populations are poorly understood. These beetles depend on elderberry bushes for breeding and rearing of young and will sometimes occupy bushes growing in degraded habitat (e.g., levees). Presumably, its populations will respond positively to riparian restoration projects in the Central Valley and Delta.

STAGE 1 EXPECTATIONS: A program will have been developed to minimize clearing of levees or additional habitats will have been developed to offset levee maintenance practices and existing habitat will have been maintained. A comprehensive study will have been completed to locate populations of the beetle and assess their population size. A program will have been implemented to maintain existing habitat and plant new elderberry bushes where possible, particulary in conjunction with the restoration or riparian and riverine aquatic habitats.

RESTORATION ACTIONS

The following general targets will assist in meeting the Strategic Objective:

- Increase the numbers and distribution of valley elderberry longhorn beetle.

The following general programmatic actions will assist in meeting the targets:

- Protect and restore wetland, riparian, and grassland habitat.
- Implement control measures to eradicate invasive plant species.
- Reduce land and water management practices that degrade habitats used by these species.

MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve species habitat or population targets.

- Coordinate protection and restoration of riparian habitats with other federal and state programs (e.g., U.S. Fish and Wildlife Service recovery plans, the SB 1086 program, and the Corps' Sacramento and San Joaquin Basin Comprehensive Study) that could affect management of occupied and historic habitat use areas to avoid potential conflicts among management objectives and identify opportunities for achieving multiple management objectives.
- Within the species current range, design ERP riparian habitat enhancements and restorations to include suitable riparian edge habitat, including elderberry savanna.
- Initially direct ERP riparian habitat actions towards enhancement and restoration of habitat areas located near occupied habitat to encourage the natural expansion of the species range.
- Include sufficient buffer habitat around suitable restored and enhanced habitat areas within the species' range to reduce potential adverse effects associated with pesticide drift.

REFERENCES

Multi-Species Conservation Strategy. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

Strategic Plan for Ecosystem Restoration. 2000. CALFED Bay-Delta Program, Programmatic EIS/EIR Technical Appendix. July 2000.

U.S. Fish and Wildlife Service. 1984. Recovery plan for the valley elderberry longhorn beetle.

◆ SUISUN ORNATE SHREW

INTRODUCTION

The Suisun shrew, a subspecies of the ornate shrew, is a federal species of concern and is also listed as a California Department of Fish and Game Species of Concern. Historically, this species inhabited tidal marshes ranging from San Pablo and Suisun Bays to Grizzly Island and as far west as the mouth of Sonoma Creek, Petaluma River, and Tubbs Island. Most of the shrew's range today exists in the tidal marshes of Suisun Bay.

The primary factor affecting the Suisun shrew is habitat degradation. The shrew prefers tidal wetland to diked or managed wetlands and therefore is limited in its range.

RESOURCE DESCRIPTION

The Suisun shrew typically inhabits tidal salt marsh with adjoining upland areas where they can seek shelter during high tides and flooding. They only occur where dense foliage and driftwood can be used for nesting material and foraging. In addition, the shrew prefers areas where the soil moisture is constant. An upland component to their habitat requirements is necessary to avoid inundation during rising tides. The structure of the vegetation that occurs in their habitat may be more important than species composition. When tides are high and the ground is wet the shrew travels above ground, in the vegetation. Therefore, vegetation needs to be thick enough to provide cover for an escape corridor. The Suisun ornate shrew is an insectivore and additional diet items include crustaceans.

With the development of the Suisun Marsh came the construction of dikes and levees for flood control and protection of lands reclaimed for uses such as agriculture. These reclaimed areas supported livestock grazing, and crops such as asparagus and grain. As more and more lands were converted to agriculture, more and more habitat loss occurred which allowed for severe fragmentation of the habitat that remained. Barriers, such as roads also added to fragmentation of the remaining habitat. Development altered the landscape and geomorphology in many of these areas, which contributed to the loss of habitat.

Tidal marshes occur within the Suisun Marsh/North San Francisco Bay Ecological Management Zone of the ERP area. The elimination of much of Suisun shrew's habitat is the primary cause of the species' decline. Other factors that have contributed to the decline or potentially could inhibit the recovery of the species include human activities that disturb the species and predation by non-native species. Grazing; water management practices; land use practices; contaminants; and human-made structures, such as dikes and levees, continue to degrade the quality of remaining habitat areas.

VISION

The vision for the Suisun ornate shrew is to recover this California species of species concern and contribute to the overall species richness and diversity.

Achieving this vision will reduce conflict between protection for this species and other beneficial uses of land and water in the Bay-Delta.

Protecting existing suitable habitat areas from potential activities that could adversely affect the Suisun shrew could be achieved through cooperative agreements with land management agencies, conservation easements, or purchase from willing sellers. Restoration of adjacent upland habitat will help to recover this species by increasing habitat area. Uplands provide the shrew with refuge from flooding.

Reducing the factors that contribute to degradation of marshes would promote natural restoration and maintenance. Increasing the quantity and quality of Suisun shrew habitat and reducing the adverse effects of stressors would establish conditions necessary to maintain existing populations and allow them to recover naturally.

INTEGRATION WITH OTHER RESTORATION PROGRAMS

Existing restoration programs that could benefit the Suisun shrew are:

- Suisun Marsh Recovery Plan

- San Francisco Bay Joint Venture
- Bay Area Wetlands Planning Group
- California Costal Conservancy
- Delta Native Fishes Recovery Plan
- California Department of Fish and Game Delta/Bay Enhanced Enforcement Program
- Grizzly Island Wildlife Area
- National Estuarine Reserve Research System
- North Bay Wetlands Protection Program
- San Francisco Bay National Wildlife Refuge
- Tidal Wetlands Species Recovery Plan, and
- San Francisco Bay Area Wetlands Ecosystem Goals Project.

LINKAGE WITH OTHER ECOSYSTEM ELEMENTS

Restoring tidal habitat to increase populations of the Suisun shrew would benefit the other species found in this habitat. These species include the salt marsh harvest mouse and wading and shorebirds.

OBJECTIVE, TARGETS, ACTIONS, AND MEASURES

The Strategic Objective is to achieve, first, recovery and then large self-sustaining populations of at-risk native species dependent on the Delta, Suisun Bay, and Suisun Marsh.

SPECIES TARGET: Maintain the current distribution and existing populations of the Suisun ornate shrew, and reestablish and maintain viable species' populations throughout its historic range in the portion of the Bay Region within the ERP focus area.

LONG-TERM OBJECTIVE: Restore Suisun ornate shrew to tidal wetland habitats throughout its native range.

SHORT-TERM OBJECTIVE: Identify the remaining populations of Suisun ornate shrew and develop a conservation plan to stop the decline of this species.

RATIONALE: The Suisun ornate shrew is a listed as a species of special concern by the California Department of Fish and Game, but its limited habitat and distribution indicate it may qualify as a threatened species. Long-term survival of this subspecies is dependent upon tidal wetland, as opposed to diked wetlands, and has to have adequate physical structures and plant communities for survival. Its tidal marsh habitat has to have adjacent upland habitat for survival of the species during periods when the marsh is inundated. The upland habitat has to have relatively low densities of exotic predators. Restoring habitat would not only benefit the Suisun ornate shrew but other species, such as the salt marsh harvest mouse, that also use tidal marsh and upland marsh habitats.

STAGE 1 EXPECTATIONS: All remaining populations of Suisun ornate shrew will have been identified and protection/restoration plans developed and implemented.

RESTORATION ACTIONS

The following general programmatic actions will assist in the recovery of the Suisun ornate shrew.

- restore saline emergent wetland and transitional habitats in the Suisun Marsh/North San Francisco Bay Ecological Management Zone.
- enhance existing saline emergent wetlands and improve connectivity between wetlands.

MSCS CONSERVATION MEASURES

The following conservation measures were included in the Multi-Species Conservation Strategy (2000) to provide additional detail to ERP actions that would help achieve Suisun ornate shrew habitat or population targets.

- The geographic priorities for implementing actions to protect, enhance, and restore saline emergent wetlands and associated habitats for the California clapper rail should be: 1) western Suisun Marsh, 2) Napa Marshes, and eastern